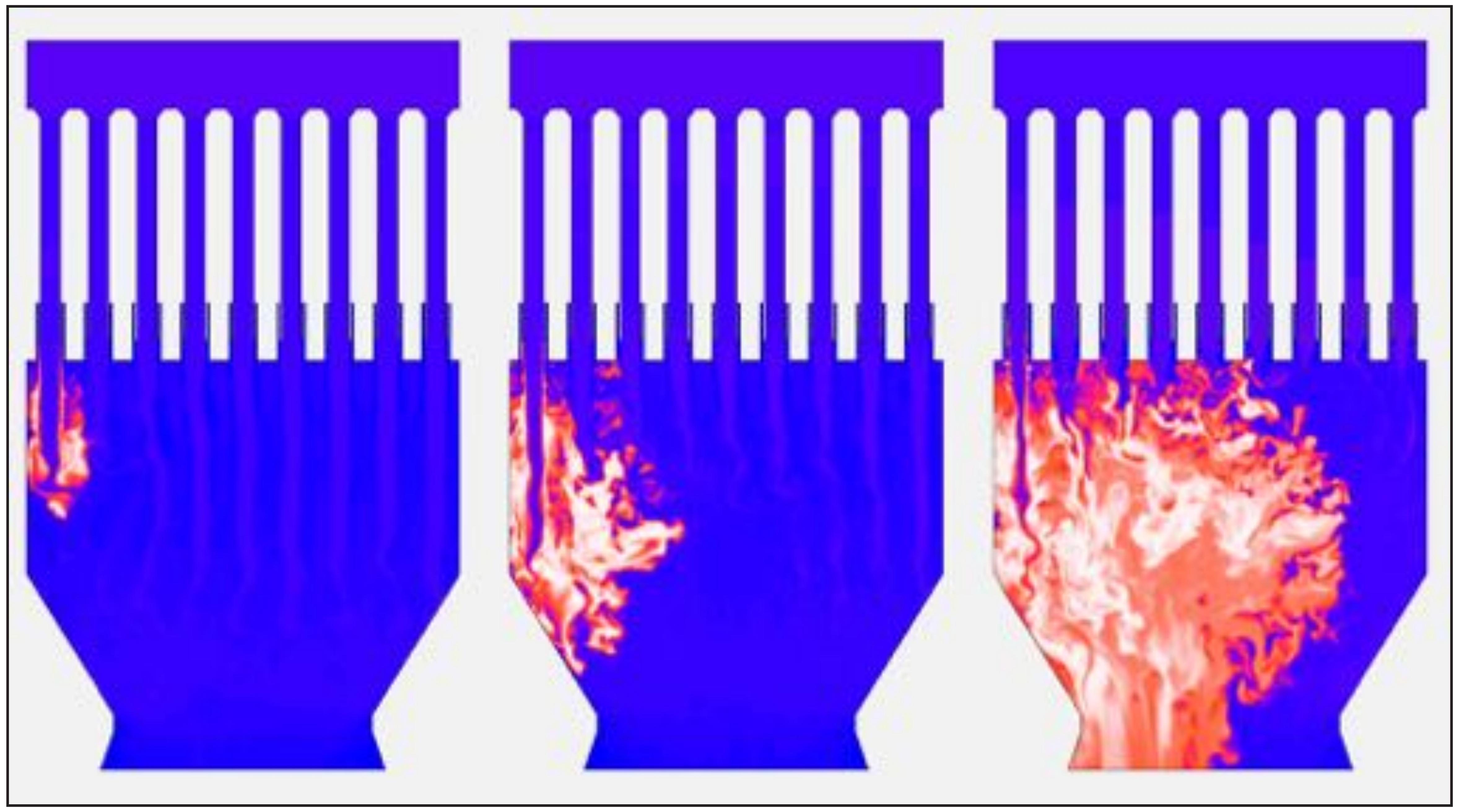
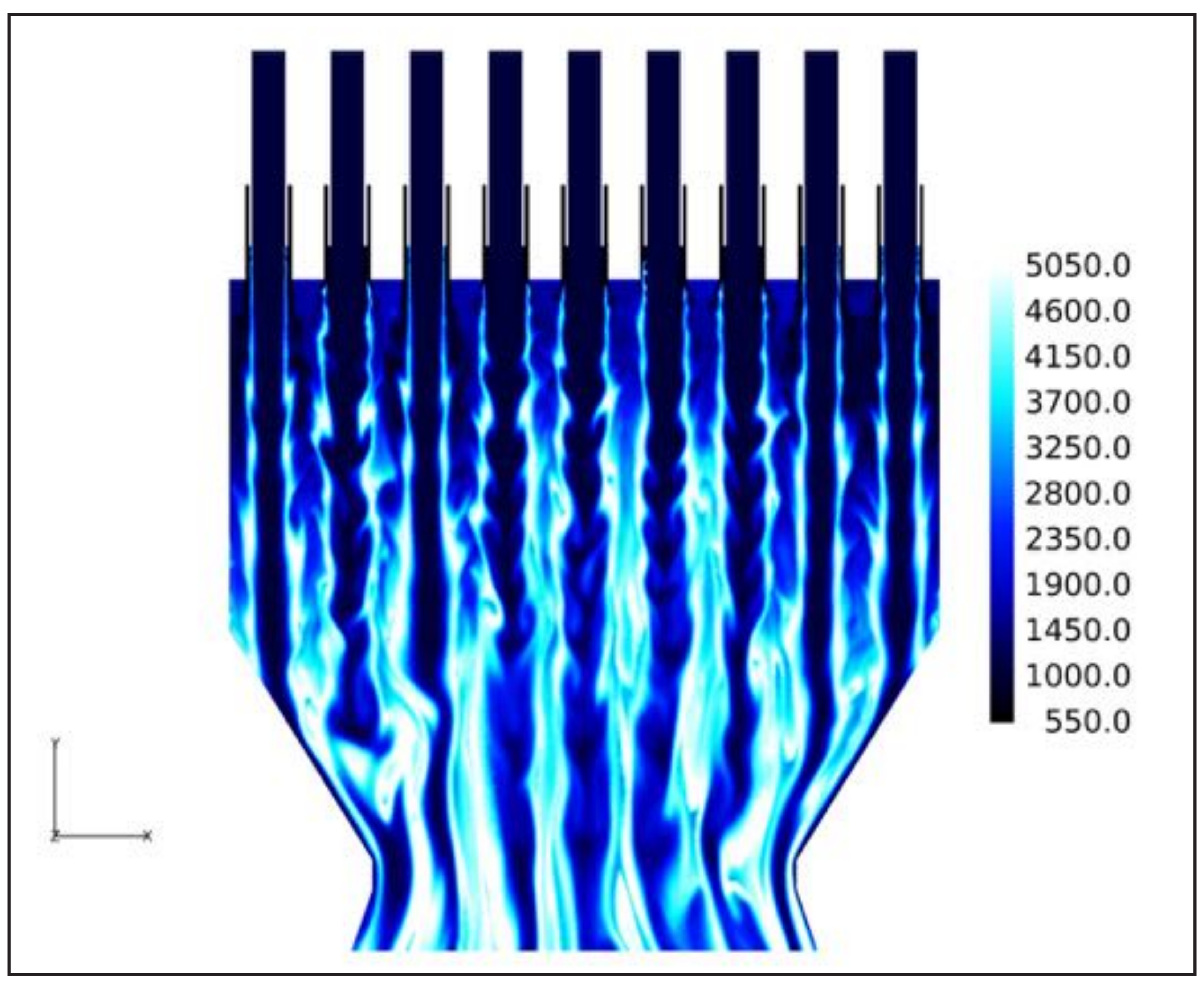
National Aeronautics and
Space Administration



Time-progression of an ignition simulation with temperature contours. From left to right: Post-ignition snapshot showing combustion of propellants from injector number 1; the combustion spreads and ignites the flow from its neighbor injector; the combustion continues to spread, and flames begin to exit the nozzle. White is the hottest temperature (about 3,300 Kelvin or 5,480° Farenheit), while blue is the coldest (about 400 K or 260° F). *Brian Richardson, NASA/Marshall*



Snapshot from a computational fluid dynamic simulation showing the stable combustion of methane with a temperature of ~3300 Kelvin or 5480° Fahrenheit. White is the hottest part of the flame while black is the coldest part of the flow. Simulations were conducted on the Pleiades supercomputer at the NASA Advanced Supercomputing Facility. *Brian Richardson, NASA/Marshall*

Lighting the Fire: High Fidelity Combustion Modeling for Deep-Space Exploration

NASA has boldly embraced the ambitious mission to send humans back to the Moon, and to Mars and beyond. Like all successful journeys, future explorers will need a reliable vehicle to travel beyond the orbit of our planet. Reliably lighting and relighting the vehicle's engine is required to propel a spacecraft to an exoplanet destination and return safely home. Despite the successes of past NASA programs, relatively little is understood about how to design a chemical propulsion system that can be reliably ignited in the vacuum of space without an expensive testing campaign. This work harnesses the power of supercomputing to design ignition events and support the next generation of NASA in-space propulsion systems.

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